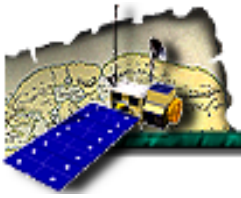

HOME ELECTRIC POWER MEASUREMENT

OVERVIEW

Students will measure the time interval for one revolution of their home electric watt-hour meters for various appliances. From this they will calculate the power being used by each and the cost per hour.

CONCEPTS

- To promote conservation of energy sources it is important to know how much energy is used in the house for heating, cooling, and other electrical appliances.

MATERIALS

- Home electric watt-hour meter
- Stopwatch or wristwatch with seconds hand.

PREPARATION

The teacher should make measurements and do the calculations at home before instructing students.

PROCEDURE

Engagement

Energy conservation is important because increased atmospheric carbon dioxide from burning fossil fuels may contribute to global warming (*Climate - Human Interactions*). The major energy sources for electric energy generation are the burning of coal, oil, and natural gas. Renewable, non-polluting sources are hydroelectric, windmill, solar, and geothermal; together these produce about ten per cent of the electrical energy used in the U.S. Your electric bill is based on the total energy in kilowatt-hours (kwh) used during a one month period. Energy (watt-hours) = power (watts) x time (hrs). The cost of operating a 100-watt light bulb for ten hours or a 1000-watt heater for one hour is the same.

Activity

1. Observe your electric watt-hour meter. Focus on the rotating disk with a black reference mark.
2. Use the K_h value shown on your meter or, if unavailable, use a K_h factor of 7.2 watt-hours per revolution.
3. With the refrigerator off, estimate the time for one revolution of the disk with no other major appliances on. (Clocks, “instant on” TVs, etc. will use a small amount of energy.)
4. With the refrigerator on, time one revolution and record the time in the table.
5. Other appliances can also be measured if you make sure to observe the meter while each appliance is on and again when each is off. The largest power users are air conditioners, electric water heaters, and electric ranges.
6. Use the following equation as an example to calculate the power for one appliance where 1 revolution takes 26 sec and the K_h is 7.2 watt-hr. (when making your calculations, replace 26 sec with what you actually measure and use the appropriate K_h value):

$$Power(watts) = \frac{7.2(watt-hr)}{1(revolution)} \frac{1(revolution)}{26(\sec)} \frac{3600(\sec)}{1(hr)}$$

For the other appliances you may wish to estimate by using a time ratio. In this example where K_h is 7.2 watt-hr, 26 seconds per revolution indicates a power usage of 1000 watts.

7. Calculate for each appliance measured the hourly cost of operation for the rates shown in the table below. For example if you calculate a power usage of 100W in Step 6, then in the "Cost/hr" column labeled "10" you'd figure: (100 watts)(10 ¢/kwh)(1hr) = 1¢.

Appliance	Time (sec) for 1 rev.	Power (W)	Cost/hr in cents at rate/kwh of:			
			6	8	10	12
Refrigerator						
Elec. range						
Air condit.						
TV						
Other						

	Day 1	Day 2	Diff.	Cost
Dial readings (kwh)				

8. Record the 6-digit dial reading and repeat at the same time the next day to estimate daily usage.

Explanation

The electric watt-hour meter is used by the power company to measure the energy used in a given time period and bill the customer for that consumption. The meter adds the number of revolutions and converts that to kwh for the meter reader to record.

EXTENSION

Share the above findings including the cost columns with parents, who may be interested in the results. Compare your cost estimates with your household's monthly electricity bills.

Many newer household appliances have literature that estimates their expected power usage and cost. If available, compare these manufacturer estimates to your results.

SOURCE

San Juan Institute.